New Energy Cities Workshop
Next Generation Infrastructure

January 27, 2011

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Pioneering the Clean Energy Economy in the Northwest

What Is the "Smart Grid"?

- A range of technologies that makes grid operations more efficient
  - Sensing and measurement tools to monitor operations (e.g., prices and power flows) for efficiency and reliability
  - Communications for two-way information flows
  - Advanced controls to act on information and adjust operations
  - Interfaces and decision-making tools to allow operators to interpret data and to act on it
  - Advanced power storage and transmission/distribution tools

Smart Grid Potential Benefits

- Increased efficiency: balancing demand and supply in light of prices and reliability needs
  - BGE (Baltimore) found a 33% reduction in "critical peak" load due to wireless controls of select customers' energy use
- Optimizing the grid
- Integrating variable renewable energy resources
- Better service

Smart Grid Adoption Challenges

- Capital turnover varies among utilities (e.g., meter switch-outs)
- Common standards not yet in place
- Customer education
- Rate issues need to be addressed (time-of-use pricing, low-income customer effects, potential "stranded" assets)
- So…learning is underway, building upon trials and with larger resources to go to those who make quick adjustments

Smart Meters

- Requires new meters, as well as a network to read and communicate with meters, and a data management system to to make them useable to utility operators (e.g., billing)
- Down to 15-minute measurements per customer
- Rollout costs vary
  - $300 per residential, $1,500 per industrial
- Added costs for network access (wireless) and data collection, plus back office tools to use data
- Enel (Italian utility) calculates a 4-year payback from its 25-million meter deployment, due to better collections and lower cost of service
- In U.S., smart meters have been installed or proposed for over 50% of customers in 21 states (including Idaho)

Home Area Networks/Appliances

- Connects appliances, thermostats, plug-in cars, in-home displays, load-control switches to smart meter
- Still very fragmented
- Google is developing such a network with easy display for customer use
- Appliances can be controlled to address both price and reliability events
    - Water heaters
    - Clothes dryers
- Appliances can operate with or without a home-area network

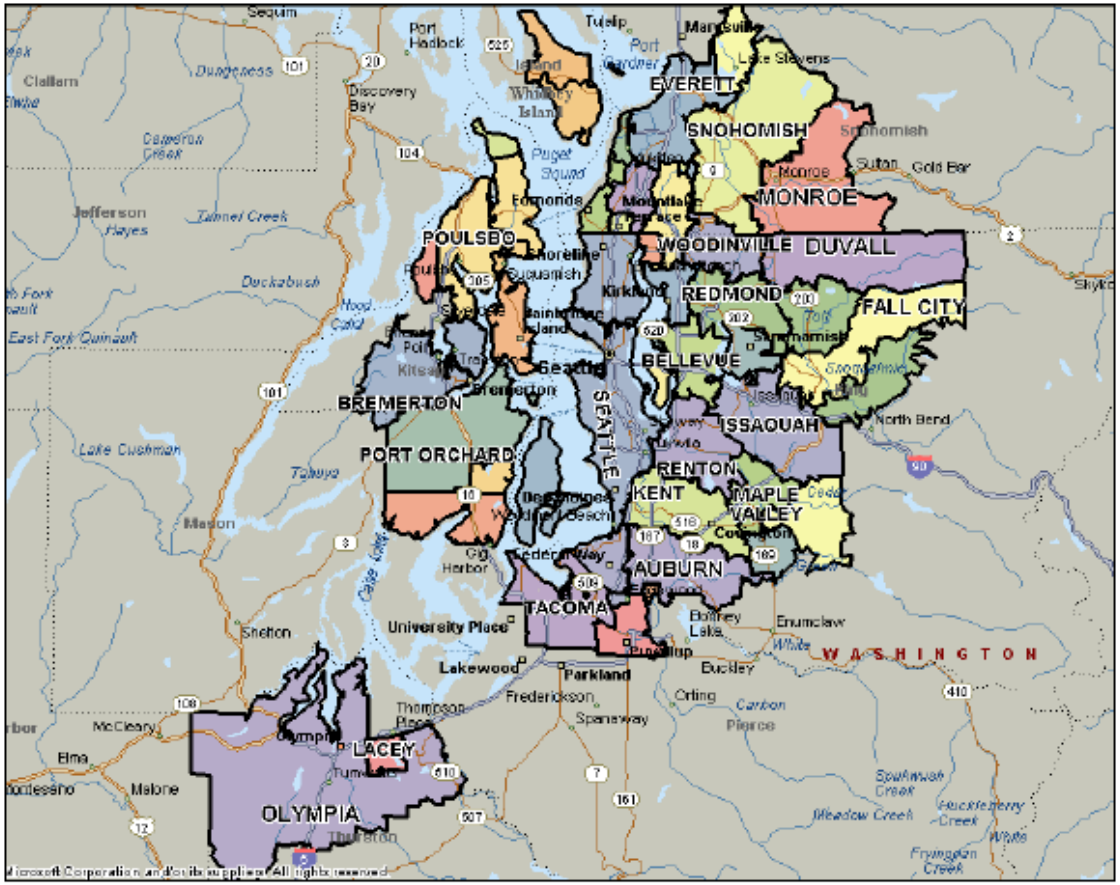
Next Generation Edmonds

- Laying the Smart Grid Foundation
  - SnoPUD has a five-year plan for smart grid implementation
    - Connect substations with fiber optics
    - Digitize substations
    - SCADA system
    - Install smart meters 2014-2015

Electric Vehicles Are Coming

- Nissan Leaf and Chevy Volt launching in Washington State
- Industry on target to launch 10-12 electric vehicle models over the next three years

EV Project Participants



ecotality

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EV Carbon Footprint in Edmonds

lbs CO2e/100 miles	
77.6 lbs	Average car (25 mpg)
38.8 lbs	Hybrid car (50 mpg)
3.7 lbs	Leaf (100 mile range)
5.0 lbs	Leaf (73 miles range)

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Plug-In Electric Vehicles

- Potential energy storage
- Fuel costs can be a quarter of the cost of gasoline…
- …but battery life and capacity still needs progress
- Today: higher in cost than existing hybrids
- Plug-ins with smaller batteries, frequent charging and limited range (20 miles) more cost effective today than longer-range vehicles
- Most major car makers are planning to introduce PHEVs
- California mandate for car makers to produce cars by 2012

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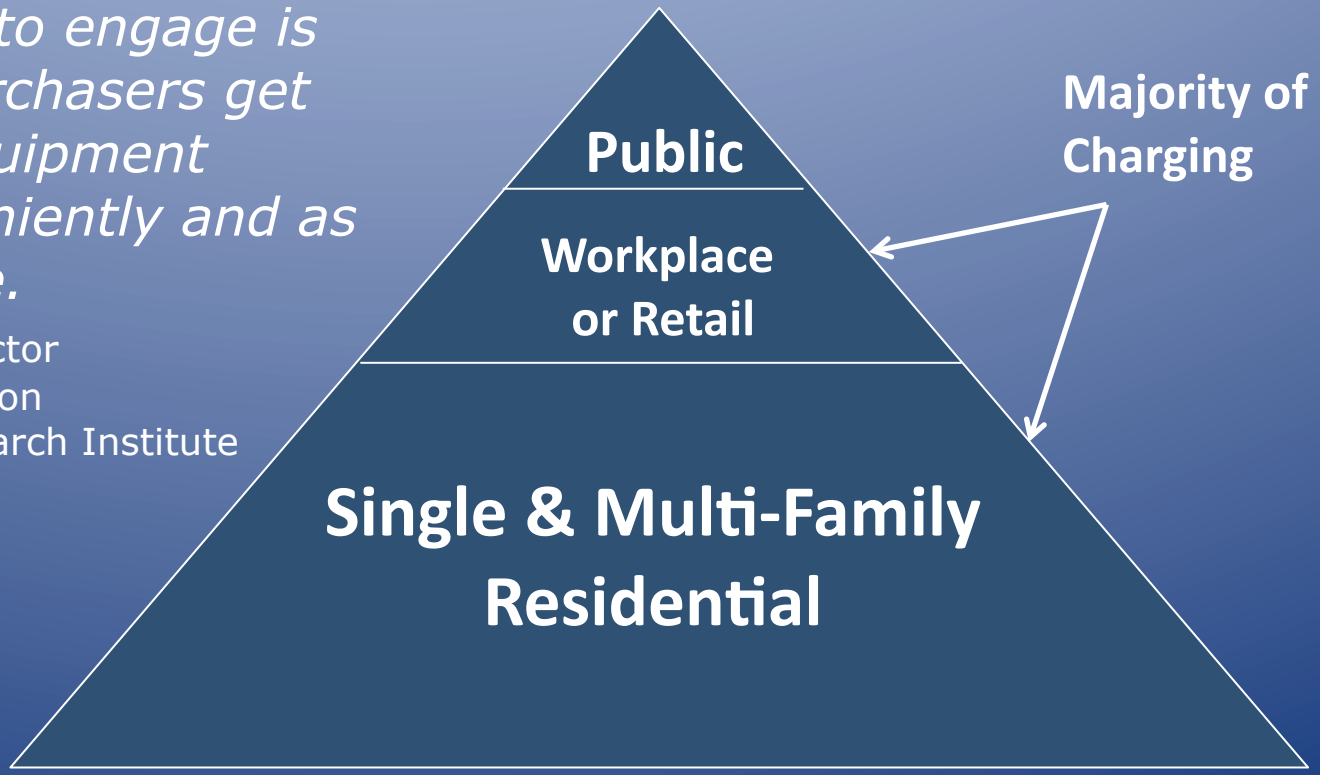
EV Areas of Attention

- Electric Supply & Distribution
- Charging Stations
- Public Charging Network
- Land Use & Development Codes
- Outreach and Communications
- Municipal Fleets

EV Infrastructure

The most important place for utilities and cities to engage is to help vehicle purchasers get home charging equipment installed as conveniently and as quickly as possible.

- Mark Duvall, Director
Electric Transportation
Electric Power Research Institute



EPRI ELECTRIC POWER RESEARCH INSTITUTE

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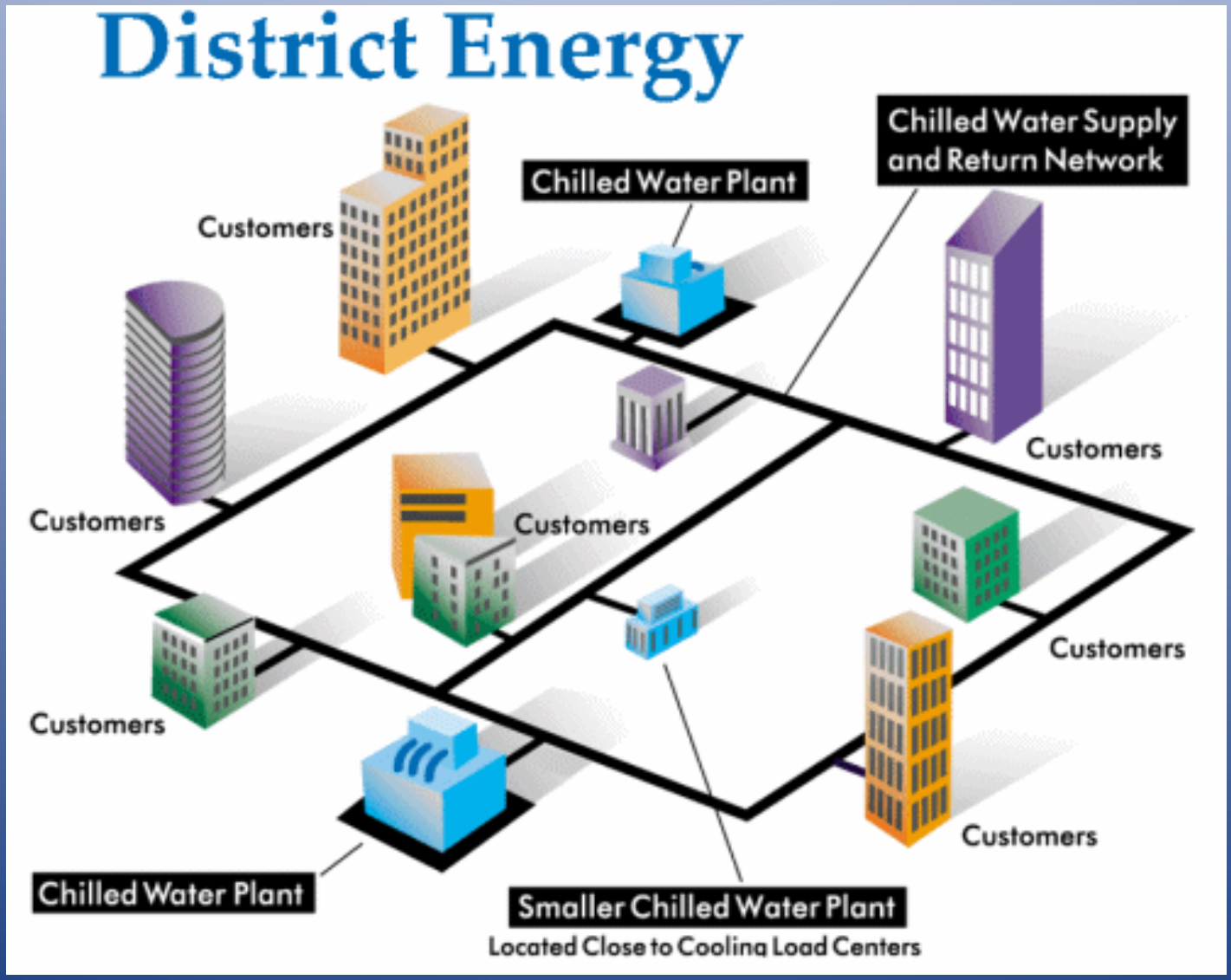

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District Energy Systems

System	Energy Source(s)
Seattle Steam (Downtown Seattle)	Biomass (in 2009) and natural gas – heat only
District Energy St. Paul (Downtown St. Paul)	Biomass and natural gas – heating, cooling
Brewery Blocks (Downtown Portland)	Electricity – cooling only
SEFC NEU and Central Heat (Vancouver, BC)	Central sewer heat and natural gas
Lonsdale Energy Corporation (North Vancouver, BC)	Natural gas mini-plants – heat only
Dockside Green (Victoria)	Central biomass and natural gas – heat only
Revelstoke, BC	Central biomass plant
Sun Rivers (Kamloops,BC)	Distributed ground source heat pumps
Aalborg District Heating (Denmark)	CHP, municipal solid waste, biomass
Olympic Village (Whistler)	Waste heat - sewage plant w/ gas, ambient loop
Stockholm (Sweden)	Multiple energy sources

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Technical Introduction

End uses in the analysis of neighborhood energy utility (NEU) system concepts

- Space Heating, Domestic Hot Water, Cooling

Major system components (first three typically owned and operated by utility)

- Energy Center(s) where energy is extracted, produced and rejected
- Community Distribution System(s) through which energy is distributed to customers
- Energy Transfer Stations (ETS) where energy is transferred to customers and metered
- Building HVAC Hydronics within the buildings beyond the ETS

Building HVAC hydronics are typically the responsibility of the developer

- Hydronics, sub-meters, in-building conversions, air-handling equipment, controls
- Must be compatible with district energy service

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Start Small, Think Big

- The NEU provides a sound infrastructure and business model that can be expanded and replicated

- European cities such as Copenhagen and Stockholm started small, and expanded over time into large scale DE systems that are integrated with liquid and solid waste management programs

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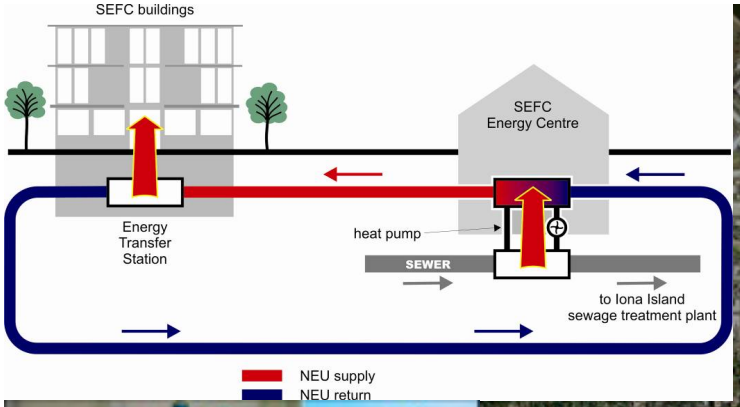
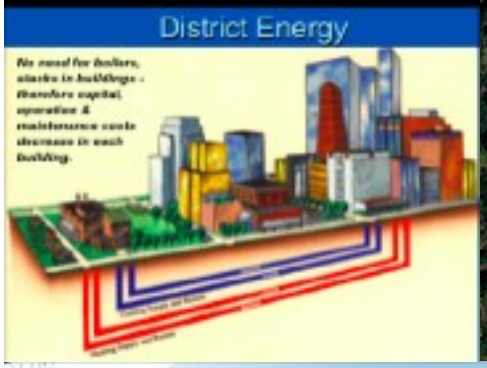
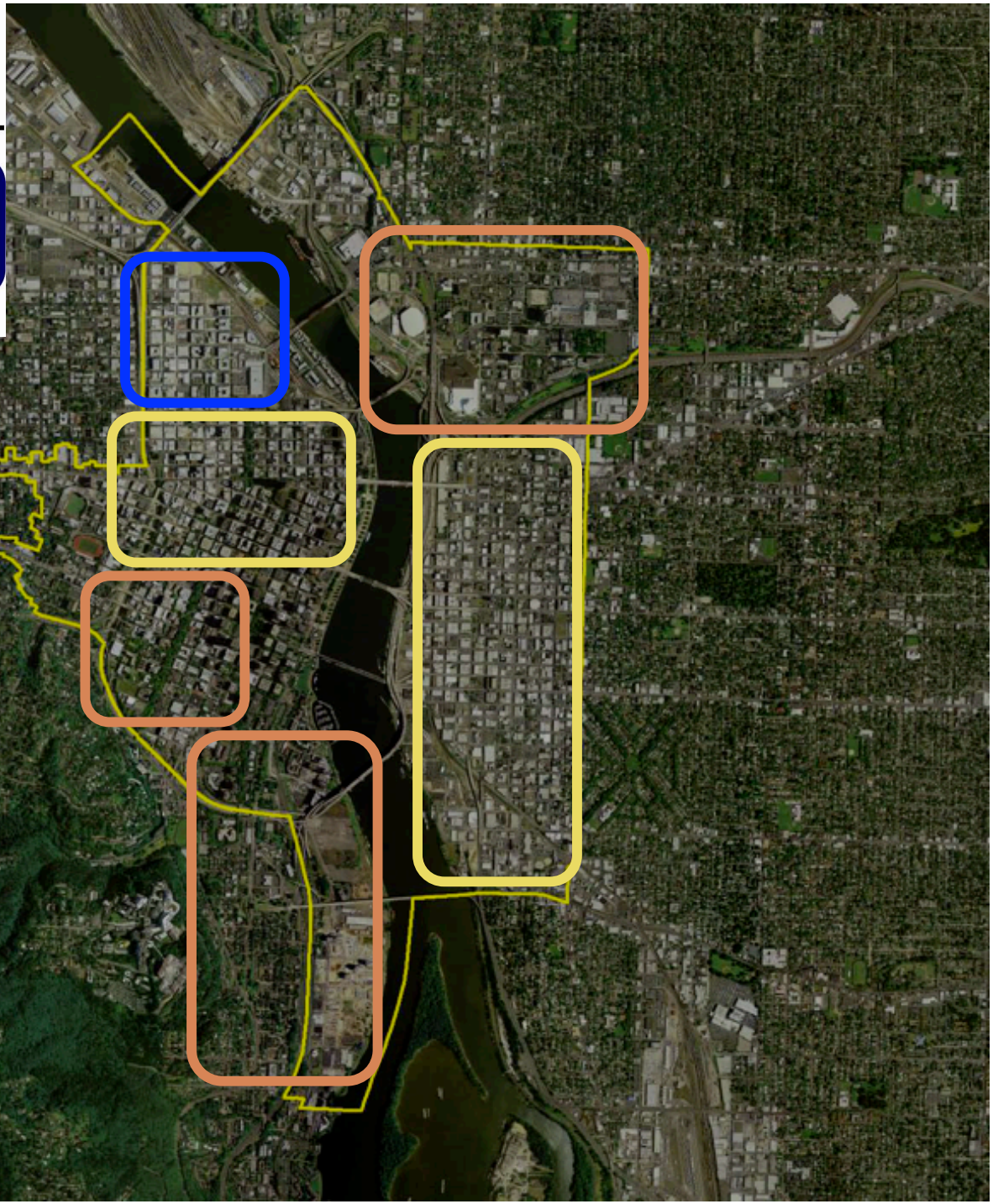

SEFC buildings
SEFC
Energy Centre
Energy
Transfer
Station
heat pump
SEWER
to Iona Island
sewage treatment plant
NEU supply
NEU return


District Energy


Community
Energy Centre



Technology Options

- Heat recovery – waste process heat
- Heat exchange – ground-source, water-source, sewer lines, waste-water plants
- Biomass – waste wood, pellets, hog fuel
- Natural gas
- Bio-gas – digester methane, industrial process gas
- Municipal waste combustion

What's wrong with electric heat?

Inefficient use of electricity for thermal uses (i.e., space heating & domestic hot water)

Even simple heat pumps improve efficiency by 2-3 times that of electric resistance

Virtually impossible to retrofit buildings over time

Prohibits use of innovative systems to use waste heat

Long-term burden of increasing energy prices will be on building occupants

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Vancouver 2010 Olympic Village Renewable Energy Supply Strategy

- Utilize renewables to provide “base load.” In first phase, 70% of annual thermal energy supplied with raw sewage heat recovery.
- NEU to be supplemented by solar modules located on rooftops of 3 Olympic Village buildings
- Natural gas boilers used for back-up and peaking heat. This ensures reliability and affordable utility rates.

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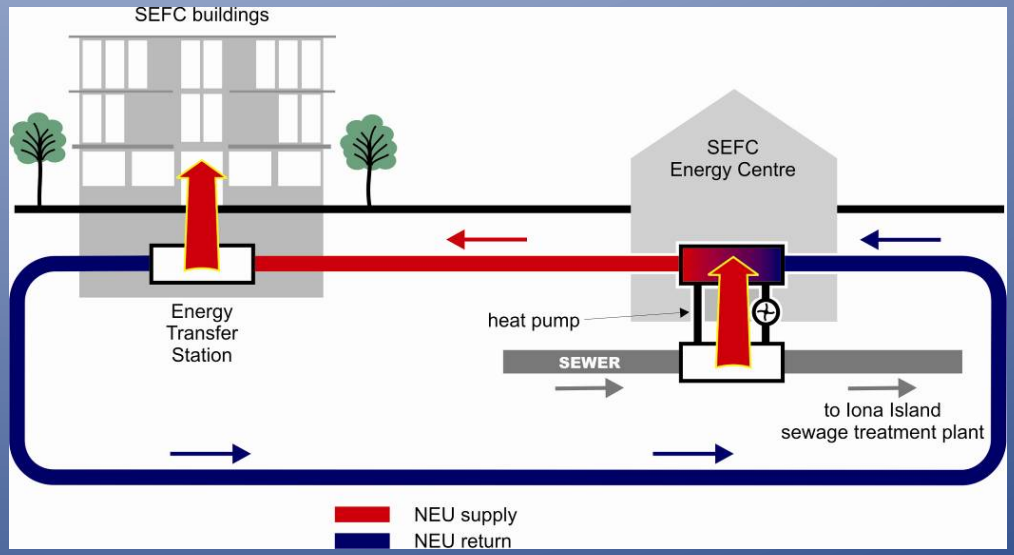
What is Sewage Heat Recovery?

- Will be integrated with a new municipal sewage pump station
- Heat Pump will capture waste heat from screened raw sewage.
- Similar to geo-exchange, but higher efficiency and lower cost.
- Low Emissions of GHG and other combustion sourced pollutants



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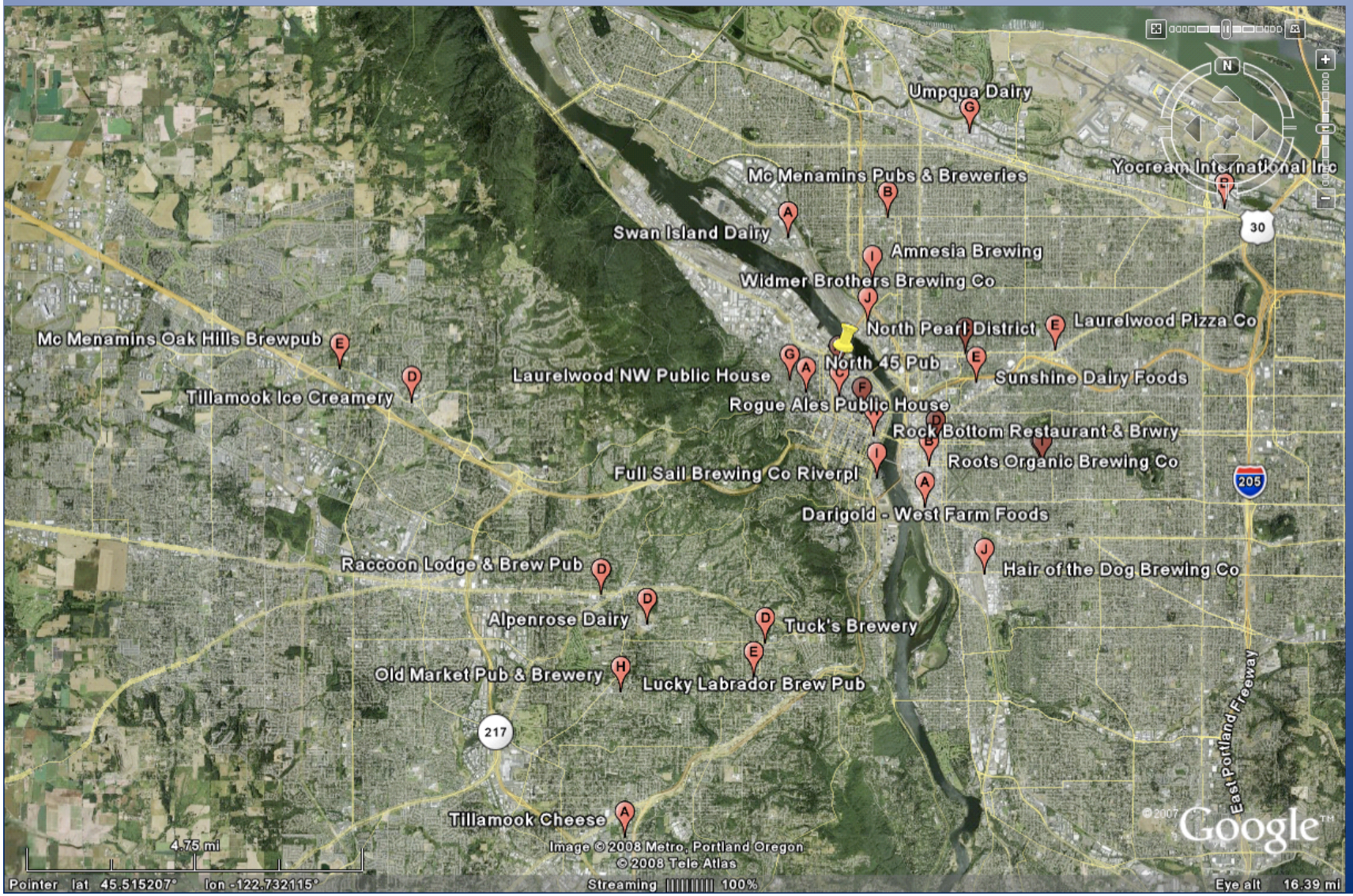
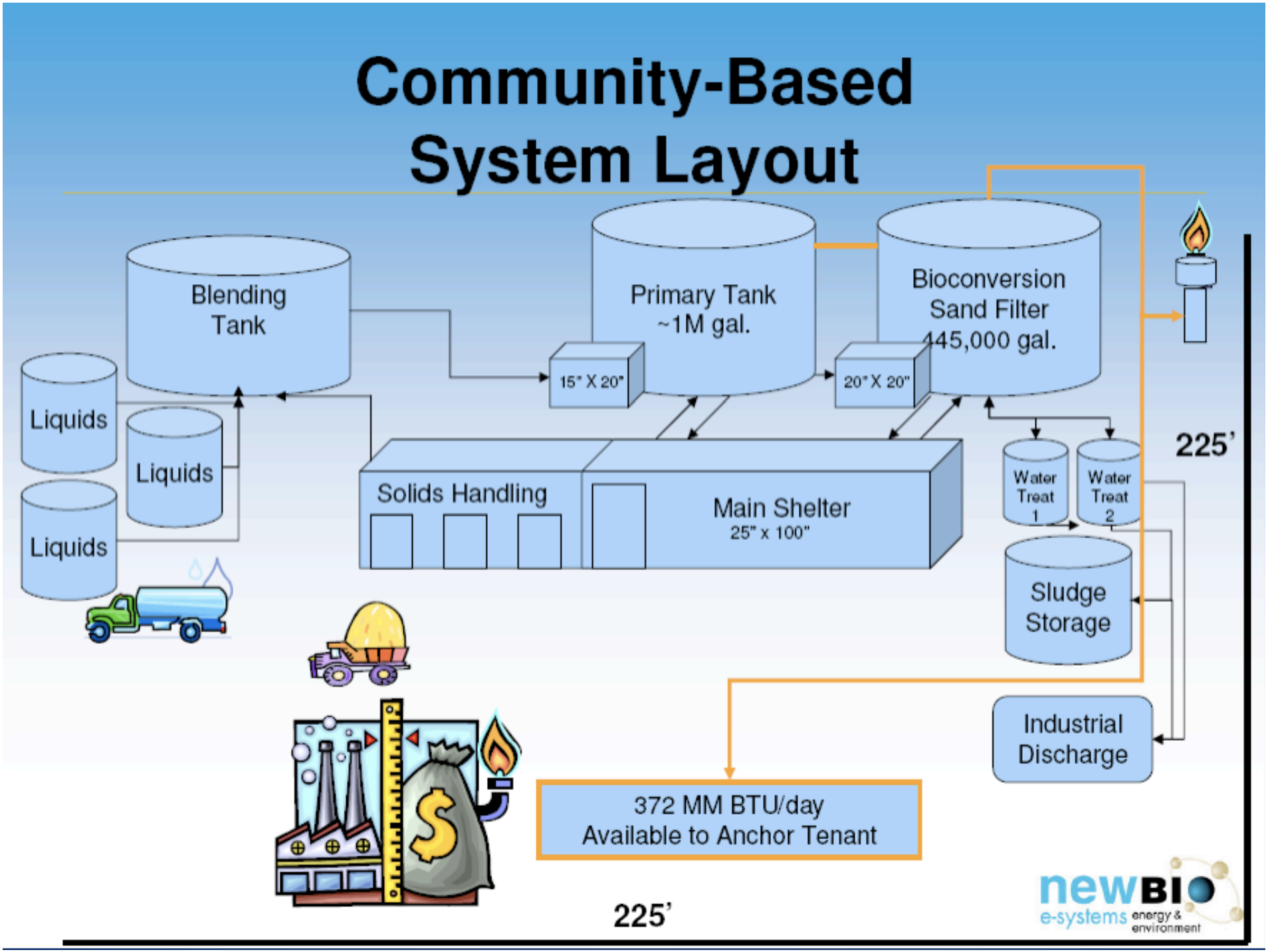
Thermal Energy from Organic Waste?



Community-Based System Layout



Making District Energy Happen

- Area planning & policies related to energy & infrastructure
- Identify major developments & infrastructure projects
- Assess long-term, stable energy demand
- Identify core distribution system, with extensions & building connections
- Evaluate energy sources - local, renewable, waste
- Business analysis - investment decision, phasing plans, risk management, rates & governance
- Include property owners & community stakeholders throughout the process

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Inc. 1890